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IN REPLY

REFER TO DSCC-VAI (Howard E. H. Jenkins/(614-692-0560))

July 26, 2004

Military/Industry Distribution

SUBJECT: Initial Draft of MIL-DTL-21393B, "Microphone, Dynamic M21393/1-01, M21393/2-01, M21393/3-01", Project number 5965-0376-000; MIL-DTL-21393/1, "Microphone, Dynamic M21393/1-01", Project number 5965-0384-001; MIL-DTL-21393/2, "Microphone, Dynamic M21393/2-01", Project number 5965-0384-002; MIL-DTL-21393/1, "Holder, Microphone, M21393/3-01", Project number 5965-0386-000.

The initial drafts for the subject documents are now available for viewing and downloading from the DSCC-VA Web site:

<http://www.dscclia.mil>

or

<http://www.dscclia.mil/Programs/MilSpec/DocSearch.asp>

Major changes include conversion to a general specification with 3 (three) new specification sheets, complete update of the format and references, introduction of a reliability test to be used for first article testing and conformance inspection (when specified in a contract), and removal of the Stray Magnetic Field requirement. NSN's 5965-00-845-6325 (M21393/1-01), 5965-01-413-7290 (M21393/2-01), and 5965-01-408-4190 (M21393/3-01) are to be supported by the subject specification sheets.

If these documents are of interest to you, provide your comments or suggested changes by e-mail to Howard.E.Jenkins@dla.mil or by fax at (614) 692-6939. You may also send comments or suggested changes on Compilation of Comments Form 155, shown at the end of the document posted on the web.

Comments or suggested changes that are not editorial in nature should include justification. Industrial activities should indicate whether they are commenting from the standpoint of a "User" or "Manufacturer." Military review activities should forward their comments to their custodians in sufficient time to allow for consolidating the departmental reply. Military departments must identify their comments as either "Essential" or "Suggested." Essential comments, which must be accepted or withdrawn, should be supported by test data unless they obviously require no data.

Please return comments to this Center no later than 45 days from the date of this letter. Any further coordination concerning this document will be circulated only to firms and organizations that furnish comments or reply that they have an interest.

If you do not have access to the world wide web or you have problems downloading this document, please notify <mailto:Howard.E.Jenkins@dla.mil> by e-mail address by telephone at 614-692-0560 or fax number 614-692-0560.

Sincerely,

/signed/

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Note: This initial draft, dated July 20, 2004 prepared by DLA-CC, has not been approved and is subject to modification. DO NOT USE FOR ACQUISITION. Project: 5965-0376

INCH-POUND

MIL-DTL-21393B
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SUPERSEDING
MIL-M-21393A (AS)
1 July 1960

DETAIL SPECIFICATION

MICROPHONE, DYNAMIC, M-21393/1-01, M21393/2-01, AND M21393/3-01

This specification is approved for use by all
Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope – This specification covers 2 (two) hand-held Dynamic Microphones, with or without a self-contained transistor amplifier and different connectors for use in unique military equipment. A wall-mounted holder is also included.

1.2 Classification – The microphones are of two types and consist of the following items:

<u>Item</u>	<u>Part or Identifying Number (PIN)</u>	<u>Applicable Paragraph</u>
Microphone, Dynamic (with amplifier)	M21393/1-01	3.5.1.2
Microphone, Dynamic (without amplifier)	M21393/2-01	3.5.1.2
<u>Mounting</u>		
Holder, Micro- phone	M21393/3-01	3.5.4

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Commander, Defense Supply Center Columbus, Attn: VAI, 3990 East Broad Street, Columbus, Ohio, 43218-3990 or emailed to <mailto:Sound@dsccl.dla.mil>. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://www.dodssp.daps.mil/>.

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2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MILITARY

MIL-C-55116/1	Connector, Plug, Five Pin Audio, Crimp Sleeve Terminals, Wire Strain Relief, U-229 Type
MIL-DTL-21393/1	Microphone, Dynamic M21393/1-01
MIL-DTL-21393/2	Microphone, Dynamic M21393/2-01
MIL-DTL-21393/3	Holder, Microphone M21393/3-01
MIL-DTL-642/5	Plugs, Telephone (TYPE PJ-068)
MIL-DTL-55668	Cord, Electrical; Audio, Subminiature (Retractable and Straight)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://www.dodssp.daps.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract.

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCLS)

NCSL-Z540.1	- Calibration Laboratories and Measuring and Test Equipment – General Requirements.
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(Copies of these documents are available from <http://www.ncsli.org> or to National Conference of Standards Laboratories (NCSL), 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404.)

ASTM INTERNATIONAL

ASTM D5927	- Thermoplastic Polyester (TPES) Injection and Extrusion Materials Based on ISO Test Methods, Standard Specification for
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(Copies of these documents are available from <http://www.astm.org> or ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 First article test (FAT) (microphone only). When specified in the contract or purchase order (see 6.2d), a sample shall be subjected to first article inspection in accordance with 4.3.

3.3 Materials. Materials shall be as specified herein. When a material is not specified, a material shall be used that will enable the microphone to meet the performance requirements of this specification.

3.4 General design requirements (see 4.6.3.1).

3.4.1 Marking. Each microphone unit shall be permanently and legibly marked as shown in Figure 1. The manufacturer's trademark may be added if desired.

3.4.2 Reliability (see 4.7). For operational stability, the microphones shall operate with optimum performance for 500 hours, continuously or intermittently.

3.4.3 Insulating and impregnating compounds. All such compounds including varnishes, waxes and the like, shall be suitable in every respect for each particular application. Under all service conditions including test conditions outlined in Section 4 of this specification, the compound shall allow the insulation, on which it is applied, and the microphone assembly to meet all performance and environmental requirements of this specification.

3.5 Detail requirements. The design and assembly of the microphone shall be such that the microphone is inherently stable, as to mechanical and electrical characteristics. The contractor, subject to the requirements of this specification, shall accomplish the detailed mechanical and electrical design of the microphones. The requirements are detailed herein only to the extent considered necessary to obtain the desired mechanical and electrical characteristics and performance, and permanence of the same.

3.5.1 Microphones, dynamic M21393/1-01 & M21393/2-01. The microphones shall meet the following requirements:

3.5.1.1 Function. The microphones shall convert normal speech input to electrical signals suitable for connection into the speech amplifiers and/or modulators of radio or audio equipment. The microphones shall discriminate in favor of the speech signals and against ambient noise.

3.5.1.2 Contents of the unit. The microphones shall be composed of the following:

- (1) Microphone Back Assembly, including the push-button, switch, cordage and plug, as illustrated in the specification sheet (see 3.1).
- (2) Transmitter Assembly, including the microphone element, with or without the microphone amplifier (see 3.1). The element and the amplifier shall be designed to be compatible, with each other.

3.5.2 Cordage (see 4.6.3.1.1). The cordage shall be retractile, shall have four unshielded (M21393/1-01) or shielded (M21393/2-01) stranded wire conductors (see 3.1) and conform to Type I of MIL-DTL-55668.

3.5.2.1 Anchorage (see 4.6.3.1.2). The cordage, all connections, and associated hardware shall show no signs of reduced diameter, deformation, breakage, or loosened connection(s) at the microphone and connector, following the anchorage tension test.

3.5.2.2 Connector. One end of the cordage shall be equipped with a plug, type PJ-068 IAW MIL-DTL-642/5 (M21393/1-01) or U-229 IAW MIL-C-55116/1 (M21393/2-01) (see 3.1).

3.5.3 Switch action. The switch shall be of the plunger type having an axial movement of approximately 1/8 inch. It shall be designed for operation by a heavily gloved hand. The pressure required to depress the switch fully shall not exceed 4 pounds. A pressure of at least 1.5 pounds shall be required to hold the switch closed. The switch shall not have a detent action. For the M21393/1-01, the closing of the audio and the control contacts shall occur simultaneously. The switch shall be capable of at least 100,000 operations without mechanical or electrical failure.

3.5.4 Holder, microphone M21393/3-01. The microphone holder shall conform to the dimensions shown in MIL-DTL-21393/3 and shall be suitable for permanent installation. It shall be designed so that the microphone can be quickly and easily stowed or removed by one hand. It shall hold the microphone securely regardless of position. Its weight shall not exceed 1.5 ounces (see 3.1).

3.6 Performance requirements.

3.6.1 Sensitivity (see 4.6.3.2.1). The audio output of the microphone, when measured as specified in paragraph 3.5.2 at a sound pressure level of 115 dB re 20 micro-Pascal. And at a frequency of 1000 Hz, shall be 54 ± 3 dB above 1 millivolt. The sensitivity of the microphone shall not vary by more than 3 dB after being subjected to any, or all, of the service conditions specified herein. At a simulated altitude of 10,000 feet the sensitivity shall not fall below the sensitivity at sea level by more than 3 dB.

3.6.2 Frequency response (see 4.6.3.2.2). The frequency response of the microphone, when measured as specified in paragraph 4.6.3.2, compared to the response of 54 ± 3 dB at 1000 Hz, shall be within the limits shown in Figure 5. However, the difference between any two successive readings, 100 Hz apart up to 1000 Hz or 250 Hz apart above 1000 Hz, shall not exceed 2.5 dB, under all standard and service conditions.

3.6.3 Linearity (see 4.6.3.2.3). The output voltage of the microphone shall be a linear function within 10% (ten percent), of the input sound pressure in the range of 80 dB to 125 dB re 20 micro-Pascal.

3.6.4 Microphone current (see 4.6.3.2.4). For test purposes, the microphone shall be connected as shown in the standard test circuit, figure 2, and the microphone D.C. current shall not exceed 35 milliamperes (ma).

3.6.5 Voltage transients susceptibility (see 4.6.3.3). There shall be no degradation of performance or any change in DC current of the microphone, as a result of the voltage transients test. Following such exposure, the product shall exhibit the following performance:

Sensitivity and frequency response: No more than ± 3 dB variation at any frequency.

3.6.6 Signal-to-noise ratio (see 4.2.1 and 4.6.3.4). Under standard conditions the signal-to-noise ratio shall be at least 15 dB in favor of the signal.

3.6.7 Radio interference control (see 4.6.3.5). The microphone, in terms of the generation of radio interference by the microphone and the vulnerability of the microphone to radio interference, shall be designed to meet the requirements of MIL-STD-461. Audio susceptibility requirements, as applicable to direct power input leads from either A. C. or D. C. aircraft power sources, shall not apply to the equipment specified herein.

3.6.8 Distortion (see 4.6.3.6). At any frequency between 300 and 6000 Hz, when the sound pressure at the face of the microphone is 115 dB re 20 micro-Pascal, the harmonic distortion in the output of the microphone shall not exceed 4% under standard conditions or 5% under service conditions, except at temperatures below -40°C and above +55°C where the harmonic distortion shall not exceed 8%.

3.6.9 Vibration (see 4.6.3.7). The microphone shall resist failure and degradation in performance due to repeated excessive vibration. Following such exposure, the microphone shall exhibit the following performance:

Visual examination:	No evidence of physical damage, which would cause a malfunction.
Sensitivity and frequency response:	No more than ± 3 dB variation at any frequency.

3.6.10 Impact (see 4.6.3.8). When tested, the product shall exhibit the following performance:

Visual examination:	No evidence of physical damage, which would cause a malfunction.
Sensitivity and frequency response:	No more than ± 3 dB variation at any frequency.

3.6.11 Altitude.

3.6.11.1 Pressure cycling (4.6.3.9.1). When tested for pressure cycling, the response characteristic of the microphone unit shall not show a decrease in output in excess of 4 dB.

3.6.11.2 Pressure equalization (see 4.6.3.9.2). The response of the microphone at 1000 Hz shall not vary by more than 4 dB from the reference established at 15,000 feet while the microphone is subjected to a pressure increase corresponding to a descent from an altitude of 15,000 feet (16.7 inches of mercury) to sea level (30.0 inches of mercury) at a rate of 5000 feet per minute.

3.6.12 Reliability test (see 4.7). The reliability test will be considered satisfactorily completed, when the required operating time for all microphones under test has been achieved and all failures have been resolved with corrective actions, which have been approved by the Government inspector and the procuring activity.

3.6.13 Humidity (see 4.6.3.10). The microphone shall resist degradation in performance, due to exposure to extremes of a warm, humid atmosphere, resisting such defects as corrosion, biological growth, material property changes due to moisture penetration, and effects of condensation. Following such exposure, the product shall exhibit the following performance:

Visual examination:	No evidence of physical damage, which would cause a malfunction.
Sensitivity and frequency response:	No more than ± 3 dB variation at any frequency.

3.6.14 Temperature cycling (see 4.6.3.11). When tested, the product shall exhibit the following performance:

Sensitivity and frequency response:	No more than ± 3 dB variation at any frequency.
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3.6.15 Temperature extremes (see 4.6.3.12). When tested, the product shall exhibit the following performance:

Sensitivity and frequency response:	No more than ± 3 dB variation at any frequency.
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3.6.16 Salt fog (see 4.6.3.13). The microphone shall be capable of operation in salt atmosphere as encountered in coastal areas. Prolonged periods of exposure to salt sea atmosphere shall not result in visible evidence of corrosion on any equipment surfaces. Following exposure to an extreme salt atmosphere, the product shall exhibit the following performance:

Visual examination:	No evidence of physical damage, which would cause a malfunction.
Sensitivity and frequency response:	No more than ± 3 dB variation at any frequency.

4. VERIFICATION

4.1 Classification of tests. The sampling, inspection, and test of Microphones shall be classified as follows:

- a. First article tests. First Article Tests are those tests accomplished on samples submitted prior to a production run, for approval as a satisfactory product.
- b. Conformance tests. Acceptance Tests are those tests accomplished on microphone units manufactured and submitted for acceptance under a contract.
 - (1) Group A (Individual) tests. Individual Tests are those tests conducted on each equipment submitted for acceptance under the contract.
 - (2) Group B (Sampling) tests. Sampling Tests are those tests accomplished on a quantity of equipments, as approved by the procuring activity, and which have previously passed Individual Tests.
- c. Reliability test. When required, the Reliability test shall be conducted by the contractor and within the contractor's plant. These tests shall be conducted, as part of the FAT and/or conformance inspection, when specified within the contract (see 6.2d & e).

4.1.1 Standard/Service conditions. The following conditions shall be used as a basis to establish normal performance requirements and for making laboratory bench tests on the microphone.

TABLE I. Standard/Service Conditions.

PARAMETER	STANDARD CONDITIONS	SERVICE CONDITIONS
Temperature	Room ambient ($30^{\circ} \pm 10^{\circ}\text{C}$)	Operating: (-40°C to 71°C), Non-operating: (-57°C to $+85^{\circ}\text{C}$)
Altitude	Normal ground	Operating (Sea level to 15,000 feet), Non-operating (Sea level to 40,000 feet)
Vibration	None	Microphones should withstand random excitation over the frequency range of 15 to 2,000 Hz, with energy density levels specified by the appropriate figure and table of MIL-STD-810, Method 514, Procedure I. (see 4.6.3.7 and 6.3)
Humidity	Room ambient up to 90% relative humidity	The microphones should withstand the effects of humidities up to 100 %, including conditions wherein condensation takes place in and on the equipment. The equipment should withstand the above conditions during operating and non- operating conditions.

4.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment [i.e., non-Government standard (NGS) or federal or military standard] shall be in accordance with ANSI/NCSL Z540-1 or equivalent.

4.3 First article inspection (FAT) (microphone only). When required (see 6.2d), first article inspection shall consist of all of the tests in table II.

4.3.1 Sample size. With the exception of the Reliability test, ten (10) microphones shall be submitted for first article inspection. For quantity related to Reliability test, see table VIII. The units selected shall be representative of "production configuration" in design, materials, construction and performance.

4.3.2 Inspection routine. The sample shall be subjected to the inspections specified in table II, in the order shown. All sample units shall be subjected to the inspections of Group I. The sample shall then be divided equally into two groups of five (5) units each. One group shall be subjected to the Group II inspections, and the other group shall be subjected to Group III inspections.

4.3.3 Failures. If one or more sample units fail to pass any group inspections, the sample lot shall be considered to have failed.

4.3.4 Noncompliance. If a sample fails to pass first article inspection, the manufacturer shall notify the procuring activity and the responsible Government inspector of such failure and take corrective action on the materials or processes, or both, as warranted. The manufacturer shall also take corrective action on all units of product, which can be corrected and which were manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, which is acceptable to the procuring activity, has been taken. After the corrective action has been taken, first article inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the procuring activity). Final first article approval shall be withheld until the first article inspection has shown that the corrective action was successful.

4.4 Tests required. The microphone sample shall be subjected to the tests listed in Table II and any other tests deemed necessary by the procuring activity or the responsible Government Inspector to determine compliance of the microphones with the requirements of this specification.

TABLE II. First article inspections.

Examination or test	Requirement paragraph	Method paragraph
<u>Group I</u>		
Visual and mechanical examination	3.2, 3.3, 3.4	4.6.3.1
Response Measurements.....	3.6.1, 3.6.2, 3.6.3, 3.6.4	4.6.3.2
Voltage Transients.....	3.6.5	4.6.3.3
Signal-to Noise Ratio ^{2/}	3.6.6	4.6.3.4
Radio Interference Control ^{2/}	3.6.7	4.6.3.5
Distortion.....	3.6.8	4.6.3.6
<u>Group II</u>		
Vibration.....	3.6.9	4.6.3.7
Impact.....	3.6.10	4.6.3.8
Pressure Cycling ^{2/}	3.6.11.1	4.6.3.9.1
Pressure Equalization ^{2/}	3.6.11.1	4.6.3.9.2
Reliability ^{1/}	3.6.12	4.7
<u>Group III</u>		
Humidity.....	3.6.13	4.6.3.10
Temperature Cycling.....	3.6.14	4.6.3.11
Temperature Extremes.....	3.6.15	4.6.3.12
Salt fog.....	3.6.16	4.6.3.13

^{1/} For quantity related to Reliability test, see table VIII.

^{2/} The Signal-to-Noise, Radio Interference Control, Pressure Cycling, and Pressure Equalization inspections shall apply only to the M21393/1-01 microphone.

4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A and group B inspections (see tables III & IV).

4.5.1.1 Inspection lot. An inspection lot shall consist of all products of the same type, produced under essentially the same conditions, and offered for inspection at one time.

4.5.1.2 Group A inspection. Group A inspection shall consist of 100% of each lot. All failures occurring during testing shall be documented and investigated to determine root cause. If any failures occur, those defective microphones shall not be supplied to the Government. If more than 10% of the lot fails, the entire lot shall be rejected and shall not be supplied to this specification.

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TABLE III. Group A inspections.^{1/}

Examination or test	Requirement paragraph	Method paragraph
Visual and mechanical examination	3.2, 3.3, & 3.4	4.6.3.1
Response Measurements.....	3.6.1 & 3.6.2	4.6.3.2
Signal-to-Noise Ratio ^{2/}	3.6.6	4.6.3.4

^{1/} For the M21393/3-01 holder, only the visual and mechanical examinations shall be performed.

^{2/} The Signal-to-Noise inspection shall apply only to the M21393/1-01 microphone.

4.5.1.3 Group B inspection (microphone only). Group B inspection shall consist of the inspections specified in table IV and shall be made on samples which have been subjected to and have passed group A inspection.

TABLE IV. Group B inspections.

Examination or test	Requirement paragraph	Method paragraph
Voltage Transients.....	3.6.5	4.6.3.3
Radio Interference.....	3.6.7	4.6.3.5
Distortion.....	3.6.8	4.6.3.6
Impact.....	3.6.10	4.6.3.8
Temperature Cycling ^{1/}	3.6.14	4.6.3.11
Pressure Equalization ^{2/}	3.6.11.2	4.6.3.9.2
Reliability ^{1/}	3.6.12	4.7

^{1/} The Reliability test shall be required, only when specified in the contract. When the Reliability test is required, it will replace the Temperature Cycling Test, which shall not be required. For quantity related to Reliability test, see table VIII.

^{2/} The Pressure Equalization inspection shall apply only to the M21393/1-01 microphone.

4.5.1.3.1 Sampling plan. A sample of parts shall be randomly selected in accordance with table V. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table V. Of one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE V. Group B sampling plan.^{1/}

Lot size	Sample size Group B
2 to 25	2
26 to 50	3
51 to 90	4
91 to 150	5
151 to 280	6
281 to 500	7
501 to 1,200	8
1,201 to 3,200	9
3,201 to 10,000	9

^{1/} For quantity related to Reliability test, see table VIII.

4.5.1.3.2 Disposition of samples. Samples, which have passed the group B inspection, may be delivered on the contract, if the lot is accepted and the samples are still within specified electrical tolerances. When the Life test is specified in the contract, the samples used for this test shall not be delivered on the contract.

4.6 General test procedure.

4.6.1 Test circuit apparatus. The fixtures used to position the calibrating microphone or the test microphone element, with respect to the sound source, shall be designed to minimize any possible error in acoustical measurements owing to vibration, sound transmitted from the voice tube, unstable positioning of the microphone elements, reflections from fixtures or environment (such as the interior of an altitude chamber), and ambient noise. No baffles shall be used near the sound sensitive parts of the microphone elements. The test circuit apparatus shall be assembled and connected as shown on Figures 2 and shall consist of the equipment described as follows:

4.6.1.1 Audio oscillator. The audio oscillator shall have a waveform distortion not greater than .5 per cent. It shall be used with a high quality amplifier, capable of driving a Western Electric 555 speaker, or equivalent, up to a level of 120 dB re 20 micro-Pascal.

4.6.1.2 Voltmeter. The digital voltmeters (DVM) used in the test circuit shall have a flat frequency response (+/- 1 dB) from 100 to 10,000 Hz and shall be capable of measuring voltages from 0.001 to 10 volts root mean square (v.r.m.s.).

4.6.1.3 Sound source. The sound source shall be a Western Electric 555 speaker, or equivalent. The distortion in the output of the sound source shall be such that the second harmonic is at least 35 dB, the third at least 40 dB, and the fourth at least 45 dB below the fundamental.

4.6.1.4 Signal-to-noise radio test apparatus. The Signal-to-Noise Ratio Test Apparatus shall be similar or equal to that detailed in Figure 3 and the test circuit similar or equal to that shown in Figure 4.

4.6.2 Test calibration procedure. The test calibration for measurement of sensitivity, frequency response and signal-to-noise shall be as follows:

4.6.2.1 Sensitivity and frequency response. The condenser microphone shall be mounted by means of a dummy case. A ¼ inch air gap shall separate the coupler and the microphone grid. The microphone axis shall coincide with the centerline of the mouth of the sound source. After having determined the electrical input to sound source required to yield a constant sound pressure level of 115 dB re 20 micro-Pascal the condenser microphone and the dummy case shall be removed and the microphone mounted in its test fixture as shown in Figure 2. The geometric centerline of the grid shall coincide with the centerline of the mouth of the sound sources.

4.6.2.2 Signal-to-noise.

4.6.2.2.1 Noise source. By means of suitable test apparatus and circuit shown on figures 3 and 4, provision shall be made for the production of the noise spectrum in table VI, at an rms sound pressure of 115 dB re 20 micro-Pascal as measured at the microphone diaphragm. The "noise" source shall be a loud speaker capable of producing a sound pressure of 115 dB re 20 micro-Pascal at the rear as well as the front of the microphone and the loud speaker shall be located as far away from the microphone as practicable. The calibrating microphone shall be mounted in the test rig, in the box, ¼ inch from the mouth of the signal speaker, which shall be short-circuited during adjustments of the noise spectrum.

TABLE VI. Noise spectrum.

Frequency (Hz)	Sound Pressure in dB Relative to Sound Pressure at 130 Hz
40	0
70	0
130	0
300	-5
600	-9
1000	-13
2000	-17
3000	-19
4000	-21

4.6.2.2.2 Signal source. By means of the apparatus as set up previously, provision shall also be made for the production of the following signal spectrum, table VII, at an rms sound pressure of 115 dB above a referenced level of re 20 micro-Pascal. The "signal" source shall be the driver unit. The calibrating microphone shall be positioned ¼ inch directly in front of the driver unit.

TABLE VII. Signal spectrum.

Frequency (Hz)	Sound Pressure in dB Relative to Sound Pressure at 130 Hz
130	0
300	+7
600	+8
1000	+5
2000	-3
3000	-7
4000	-9

4.6.3 Test methods. Tests required by this specification shall be conducted in accordance with the following procedures:

4.6.3.1 Visual and dimensional inspection (see 3.2, 3.3, and 3.4). Each sample selected shall be examined externally to determine conformance with this specification with respect to material, workmanship, design, weight and dimensions.

4.6.3.1.1 Retractable cordage test methods (see 3.6.2). The cord shall be tested in accordance with Specification MIL-DTL-55668.

4.6.3.1.2 Anchorage (see 3.6.2.1). While anchored at the microphone and at the connector, the cordage and the connections shall have a 20-pound axial load applied, for a period of 5 (five) minutes.

4.6.3.2 Response measurements (see 3.6). Response measurements for sensitivity, frequency response, linearity, and microphone current shall be made utilizing the test circuit on Figure 2.

4.6.3.2.1 Sensitivity (see 3.6.1). The audio output of the microphone, when measured at a sound pressure level of 115 dB re 20 micro-Pascal and at a frequency of 1000 Hz, shall be 54 ± 3 dB above 1 millivolt.

4.6.3.2.2 Frequency response (see 3.6.2). Each microphone unit shall be subjected to response tests at no less than 6 approved frequencies, such as 300, 1000, 2000, 3000, 4000 and 6000 Hz. The specified frequencies to be used will be determined by the procuring agency on the basis of tests made and information gained in the initial stages of production. Sweep or band frequency tests may be employed provided the contractor demonstrates the suitability of such tests to the procuring agency. The method of testing and the selection of frequencies shall be such that they will truly indicate the over-all response characteristics and output level of the microphone.

4.6.3.2.3 Linearity (see 3.6.3). The output of the microphone shall be measured during variation in the input sound pressure across the range of 80 dB to 125 dB re 20 micro-Pascal.

4.6.3.2.4 Microphone current (see 3.6.4). The microphone current shall be measured, utilizing the test circuit of Figure 2.

4.6.3.3 Voltage transients Test (3.6.5). The microphone shall be subjected, through its output plug, to 350-volt pulses having a width of approximately 500 microseconds and a repetition rate of 2 pulses per second (pps). The pulses shall be applied for a period of five minutes in each polarity. The microphone shall be inactive during this test.

4.6.3.4 Signal-to-noise ratio (see 3.6.6). The microphone under test shall be mounted in a test apparatus similar or equal to that shown on figure 3, with the front grid of the microphone ¼ inch from the mouth of the signal speaker. With the microphone under test connected to the test circuit similar or equal to that shown on figure 4, the noise spectrum shall be applied and the microphone output measured. The noise spectrum shall be removed and the signal spectrum applied. The output of the microphone shall be measured. The signal-to-noise ratio shall be the quotient of these measured values.

4.6.3.5 Radio interference control (see 3.6.7). With the microphone under test connected as shown on figure 6, interference tests shall be conducted in accordance with MIL-STD-461, for (internal) applications on submarines (Navy) and aircraft (Air Force and Navy).

4.6.3.5.1 Radiated emissions. The procedures of RE102, Radiated Emissions, Electric Field, and 10 kHz to 18 GHz shall be applied to the microphone under test.

4.6.3.5.2 Radiated susceptibility. The procedures of RS103, Radiated Susceptibility, Electric Field, and 2 MHz to 40 GHz shall be applied to the microphone under test.

4.6.3.5.3 Conducted susceptibility. The procedures of CS114, Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 200 MHz (see CS114 calibration limit for all applications, Curve #3) shall be applied to the microphone under test.

4.6.3.5.4 Conducted susceptibility. The procedures of CS115, Conducted susceptibility, bulk cable injection, impulse excitation shall be applied to the microphone under test.

4.6.3.6 Distortion (3.6.8). The distortion measurements shall be made for conformance with 3.6.8 employing a distortion analyzer of the wave analyzer or total distortion type (see Figure 2). The frequency range of the analyzer shall be at least 100 to 10,000 Hz with high selectivity and an input voltage range from 0.001 to 10 volts. The measurement of distortion under service conditions may be made immediately after subjecting the microphone to the temperature extremes.

4.6.3.7 Vibration (see 3.6.9). The microphone(s) under test shall be subjected to the appropriate vibration test of Military Standard MIL-STD-810, Method 514, Procedure I, Transportation: Category 7 (Jet Aircraft), Operational Service: Category 12 (Fixed Wing Jet Aircraft). The microphone shall be connected in a test circuit providing for an amplifier current of 10 milliamperes. The test shall be conducted for a period of one hour. The current shall be turned on for 2 minutes and off for 2 minutes alternately for the duration of the test period.

4.6.3.8 Impact test (see 3.6.10). The microphone unit shall be subjected to 20 random drops, from 6-foot height to a covered concrete floor. The covering shall consist of 1/8 or 3/16 inch thick asphalt tile thoroughly cemented to the concrete floor using a minimum thickness of cement.

4.6.3.9 Altitude.

4.6.3.9.1 Pressure cycling (see 3.6.11.1). – The microphone unit shall be subjected to 5 varying pressure cycles. Each pressure cycle shall consist of 30 minutes at 3.4 inches of mercury (approximately 50,000 feet) and 30 minutes at 30 inches of mercury (approximately sea level). The pressure transition shall be approximately 5,000 feet per minute. The response characteristic for each microphone unit under test shall then be measured and compared to the initial response characteristic for that microphone.

4.6.3.9.2 Pressure equalization (see 3.6.11.2). The microphone unit shall be placed in an altitude chamber and the pressure inside the chamber reduced to that corresponding to an altitude of 15,000 feet (approximately 16.7 inches of mercury). The response of the microphone unit at a frequency of 1,000 Hz shall be measured at that altitude. The response of the microphone unit shall also be measured at a frequency of 1,000 Hz, while the microphone is subjected to a pressure increase corresponding to a descent from an altitude of 15,000 feet (16.7 inches of mercury) to sea level (30.0 inches of mercury) at a rate of 5,000 feet per minute.

4.6.3.10 Humidity (see 3.6.13). The microphone shall be subjected to the humidity test, in accordance with method 507 of MIL-STD-810.

- a. The number of 48-hour cycles for this test is 5 (five)
- b. The temperature/humidity levels shall be 60°C and 95% respectively.
- c. Measurements after test: Within 1 hour after the test, the frequency response at ground level shall be measured; the microphone may then be examined for evidence of damage.

4.6.3.11 Temperature cycling (see 3.6.14). The microphone shall be placed within the thermal chamber and maintained for a period of at least 1 (one) hour or until the microphone performance stabilizes at a temperature of $25^{\circ} \pm 15^{\circ}\text{C}$. The chamber temperature shall then be reduced to -55°C and maintained at this condition for at least 1 (one) hour or until the microphone performance stabilizes. The internal temperature of the chamber shall then be increased to $+71^{\circ}\text{C}$ and maintained at this condition for at least 1 (one) hour or until the microphone performance stabilizes. The internal temperature shall then be returned to $25^{\circ} \pm 15^{\circ}\text{C}$. The number of complete cycles shall be 5. The microphone shall be removed from the chamber and response measurements made after stabilization at room temperature.

4.6.3.12 Temperature extremes (see 3.6.15).

4.6.3.12.1 Low temperature. Expose the microphone unit to an ambient temperature of -62°C for 2 hours. Remove the microphone from the cold chamber and immediately measure the response under normal room temperature conditions.

4.6.3.12.2 High temperature. Expose the microphone unit to an ambient temperature of $+71^{\circ}\text{C}$ for 2 hours. Remove the microphone unit from the hot chamber and immediately measure its response under normal room temperature conditions.

4.6.3.13 Salt fog (see 3.6.16). The microphone unit shall be subjected to the salt spray test in accordance with Method 509 of MIL-STD-810, with alternating 24-hour periods of salt fog exposure and drying conditions for 4 (four) 24-hour periods (two wet and two dry). The microphone unit shall then be washed off with tap water, to remove excess salt deposits, followed by removal of excess moisture. The visual examination and response characteristics measurement shall be immediately conducted after removal from the salt spray chamber and the above procedures.

4.7 Reliability test (see 3.6.12 & 6.2e). The microphones under test shall be subjected to a reliability test at the contractor's plant under the following simulated service conditions.

Temperature	Normal room temperature
Altitude	Normal room
Humidity	Room ambient

4.7.1 Test details. The purpose of the reliability test is to identify deficiencies in design, materials, components and manufacturing processes. Successful completion, as defined herein, does not validate compliance with Mean Time Between Failure requirements, but together with design analyses and other testing, will provide confidence that the producers' design and production processes are adequate to commence production following FAT and (if specified in the contract, see 6.2e) accept product for shipment under Group B conformance inspection.

4.7.1.1 Test quantity. A minimum of 2 and a maximum of 5 microphones shall be selected for the reliability test, as shown in table VIII. The units selected shall be representative of "production configuration" in design, materials, construction and performance. The configuration of each unit shall be recorded prior to the start of testing and shall be verified at the conclusion of the testing or upon failure of individual unit(s), by the Government inspector.

TABLE VIII. Reliability test sampling plan.

Lot Size	Quantity to be Tested
2 to 25	2
26 to 200	3
201 to 500	4
Over 500	5

4.7.1.2 Test routine. With the test circuit apparatus assembled and connected as shown on Figure 2, the test shall consist of thermal cycling, with periodic operation as shown on Figure 7. The profile of the actual test Figure may be altered to account for variations in test chamber facilities and limitations of test equipment. Description of thermal and operational profiles shall be defined in a test plan and procedure, to be approved by the Government inspector.

4.7.1.3 Test duration. The duration of the reliability test shall be 500 hours.

4.7.1.4 Performance check. At the start of test and at approximately 100 (one Hundred) hour intervals during and at the conclusion of the test, a limited performance check shall be conducted on each unit, immediately after (temporary) removal from the thermal chamber. These performance checks shall be performed during various thermal chamber temperature conditions (see Figure 7). The performance check shall consist of the following:

Sensitivity and frequency response: No more than ± 3 dB variation, at any frequency, from initial readings. (see 3.6.1 & 3.6.2)

4.7.1.5 Repair or replacement of failed microphones. Failed units under test may be replaced with new units or repaired and returned to test, with concurrence of the procuring activity and Government inspector. All failures occurring during testing shall be documented and investigated to determine root cause.

5. PACKAGING

MIL-DTL-21393B
DRAFT

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. It is intended that these microphones convert normal speech input to electrical signals suitable for connection to speech amplifiers and or modulators of radio or audio equipment. The M21393/1-01 microphone is intended for use in high noise and radio frequency interference environments on or about military aircraft. The M21393/2-01 microphone is intended for use in low noise and radio frequency interference environments, on or about military submarines.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification and the associated specification sheet (see 2.2.1).
- b. Part Identification Number (PIN) (i.e., M21393/1-01, M21393/2-01, OR M21393/3-01) (see 3.1).
- c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 through 2.3).
- d. When first article is required, based upon contractor performance history. (see 3.2).
- e. When the Reliability Test is required under the Group B conformance inspections (see 4.5.1.3).

6.3 Service conditions. The microphone should operate satisfactorily under any of the environmental and mechanical service conditions or reasonable combination of these conditions, as indicated in Military Handbook MIL-HDBK-5400 for Class 1B equipment, except that the requirements for Sand and Dust do not apply.

6.4 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table IX lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

Table IX. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and Compounds	Lead and Compounds	Toluene
Carbon Tetrachloride	Mercury and Compounds	1,1,1 - Trichloroethane
Chloroform	Methyl Ethyl Ketone	Trichloroethylene
Chromium and Compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and Compounds	Nickel and Compounds	

6.5 Cross-reference. The new items in table X are fully substitutable and may be stocked with the old items.

TABLE X. Cross-reference

DESCRIPTION	OLD	NEW
Microphone W/ Amplifier	M92C/U	M21393/1-01
Microphone W/O Amplifier	20520332-1	M21393/2-01
Microphone Holder	MT-2014/U	M21393/3-01

6.6 Subject term (key word) listing.

Amplifier
Connector
Cordage
Hand-held
Holder
Switch

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

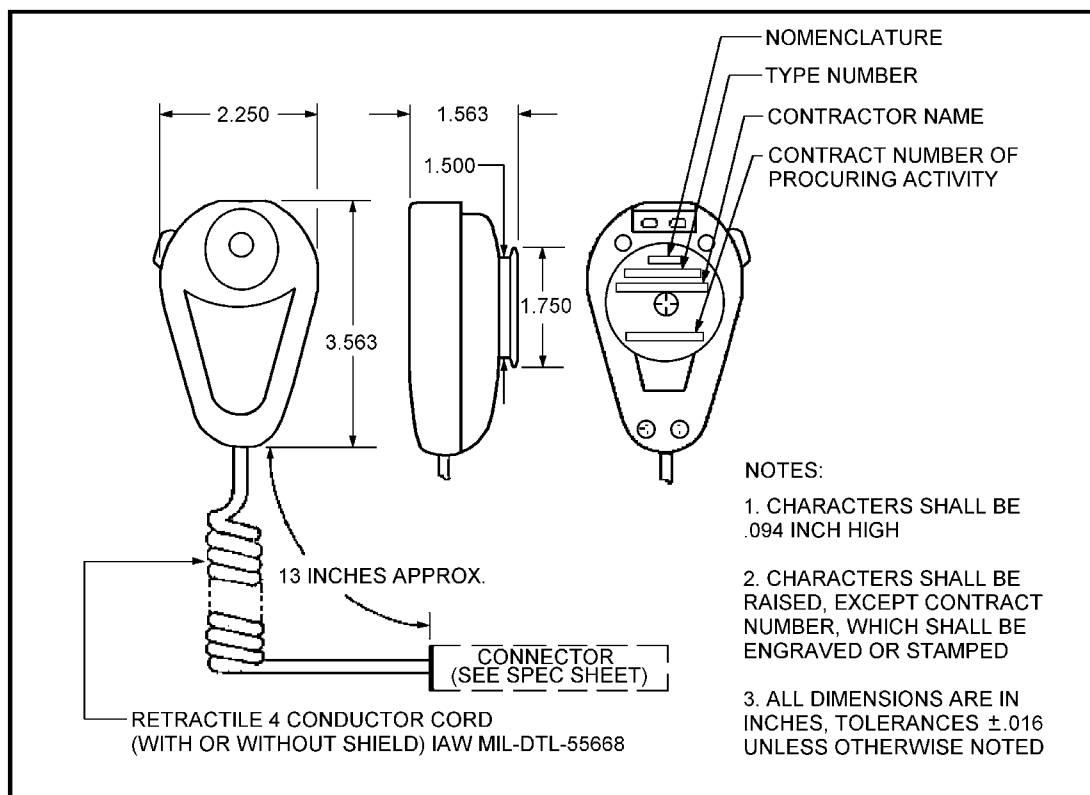


FIGURE 1. HAND-HELD MICROPHONE M21393/1-01 OR M21393/2-01

FIGURE 1. Dynamic microphones: M21393/1-01 or M21393/2-01.

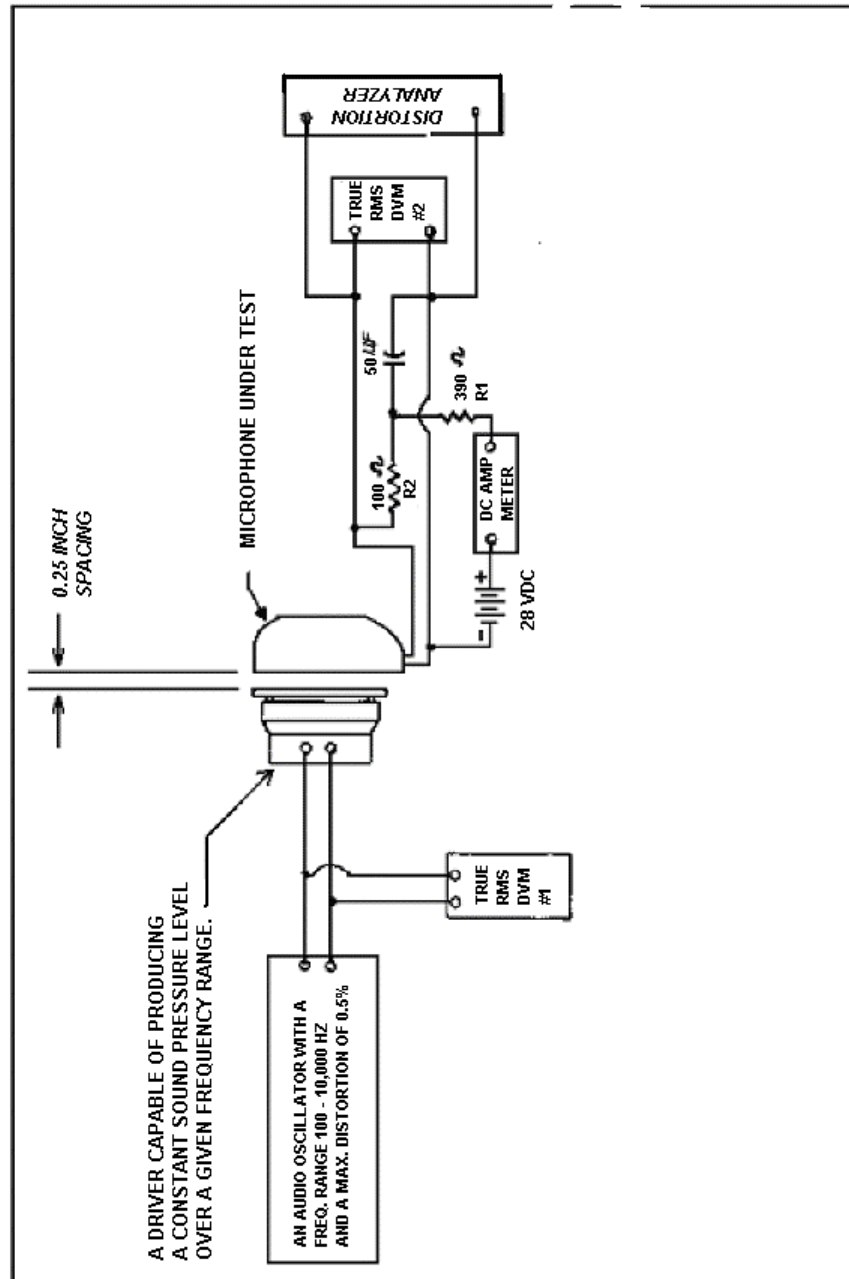


FIGURE 2. Standard test circuit for distortion, frequency response, and sensitivity.

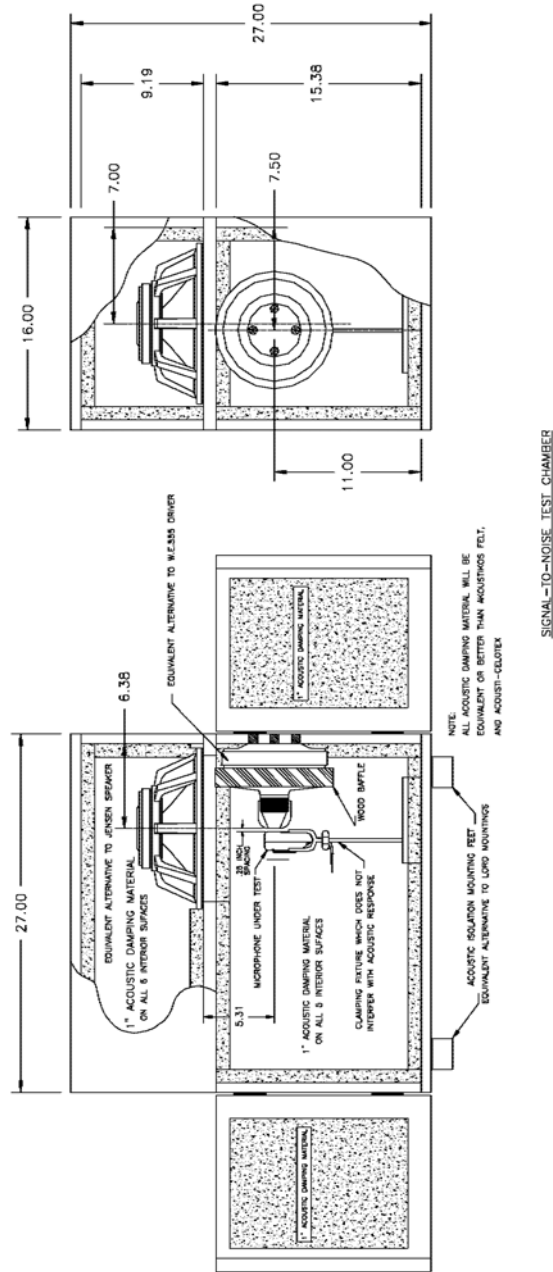


FIGURE 3. Signal-to-noise test apparatus.

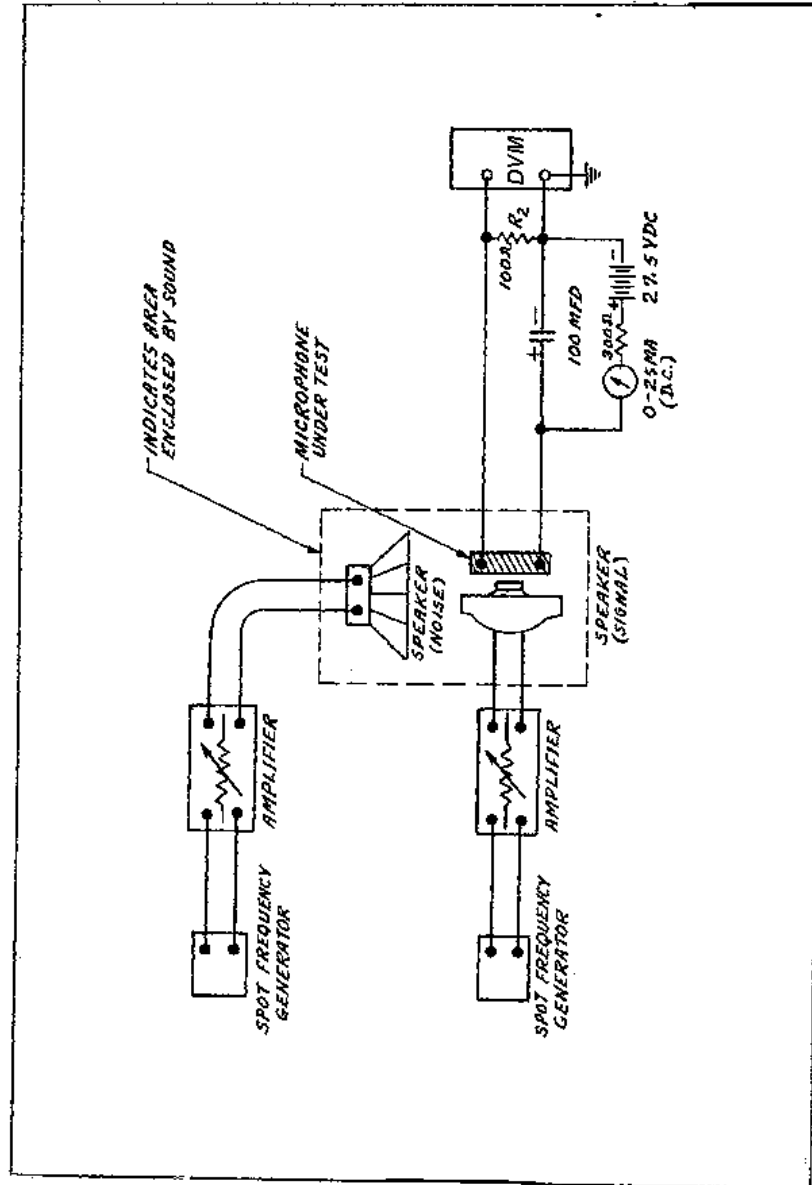
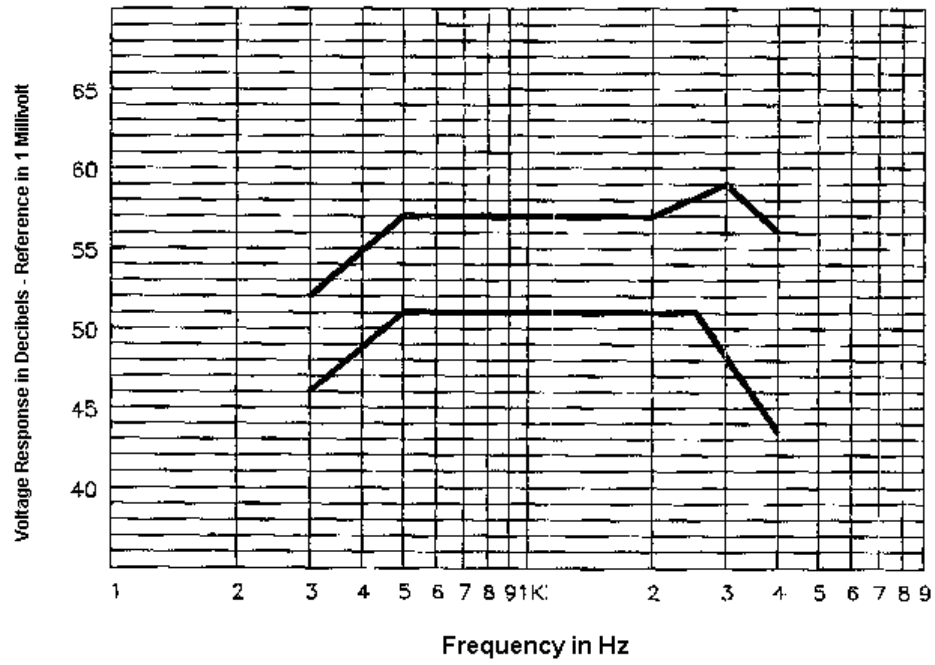


FIGURE 4. Signal-to-noise test circuit.



FREQUENCY POINTS	300 HZ	500 HZ	2,000 HZ	2,500 HZ	3,000 HZ	4,000 HZ
UPPER LIMITS (dB)	-2.0	+3.0	+3.0	-----	+5.0	+2.0
LOWER LIMITS (dB)	-8.0	-3.0	-----	-3.0	-----	-10.5

FIGURE 5. Frequency response.

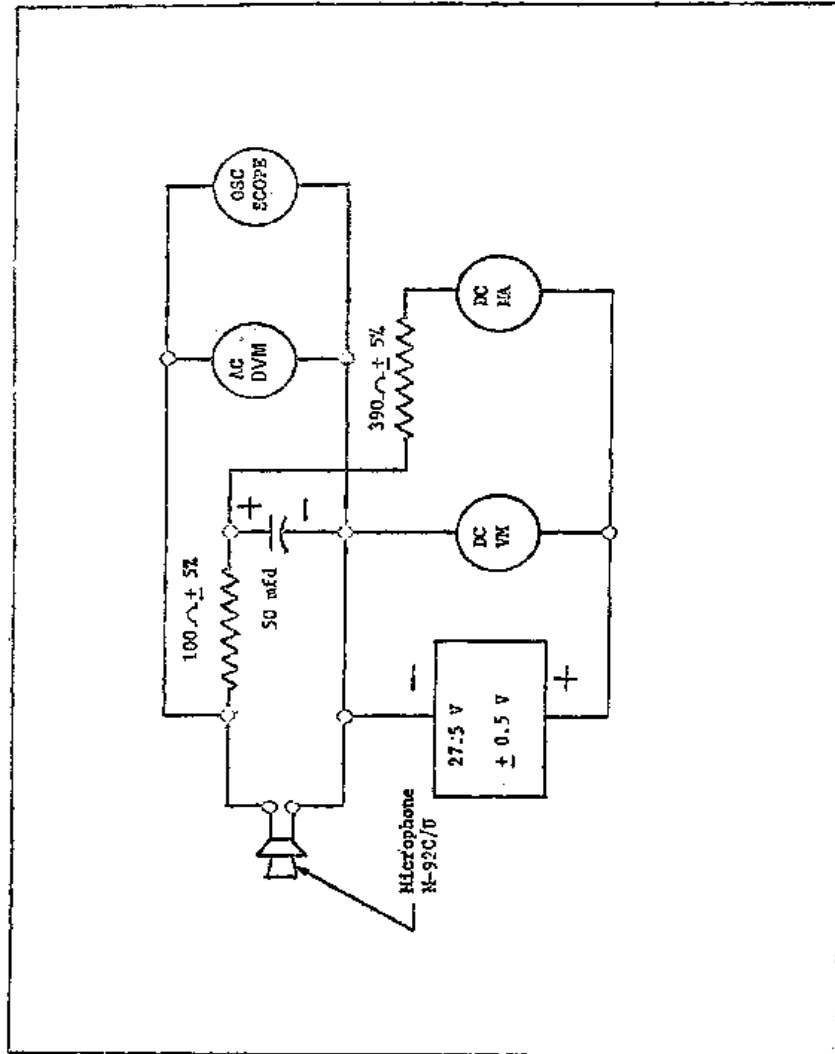
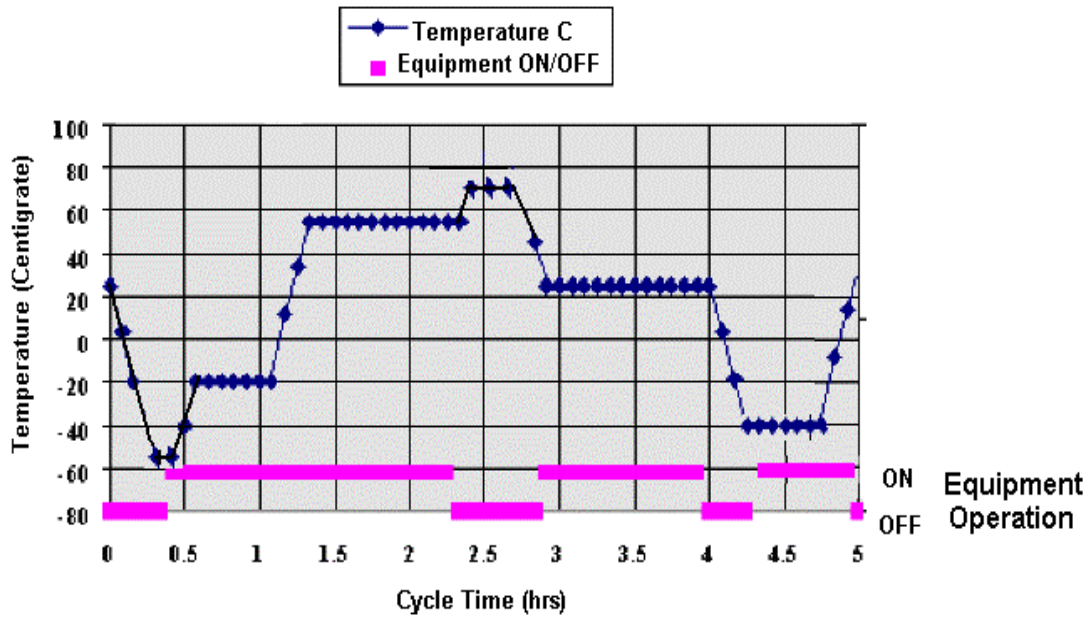


FIGURE 6. Radio interference control test circuit.



CYCLE TIME (HRS: MIN)	0	0:20-25	0:35-1:05	1:20-2:20	2:25-40	2:50-4:00	4:15-5:00
TEMPERATURE (CENTIGRADE)	+ 25	- 55	- 20	+ 55	+ 71	+ 25	- 40

FIGURE 7. Reliability test profile.

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - AS, SH
Air Force - 11, 84
DLA - CC

Preparing activity:
DLA - CC
(Project 5965-0376-000)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://www.dodssp.daps.mil>.

PROJECT NUMBER: 5965-0376		COMPILATION OF COMMENTS		COMMENT NUMBER:
DOCUMENT: MIL-DTL-21393B		COMMENTOR: IND NAME OR CODE:		[] MFR [] USER [] IND ASSOC
<u>COMMENT:</u>				
DOD USE ONLY	DEPT.	[] A [] N [] AF [] DLA [] NSA [] CNDN [] NASA	[] ESSENTIAL [] SUGGESTED	
Recommended Disposition of Comment: [] ACCEPTANCE [] NON-ACCEPTANCE (see reason) [] WITHDRAW [] MODIFY [] DISCUSS [REASON]				
Final Disposition of Comment: [] ACCEPTANCE [] NON-ACCEPTANCE [] WITHDRAW [] MODIFY				

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PROJECT NUMBER: 5965-0376		COMPILATION OF COMMENTS		COMMENT NUMBER:
DOCUMENT: MIL-DTL-21393B		COMMENTOR: IND NAME OR CODE:		[] MFR [] USER [] IND ASSOC
<u>COMMENT:</u>				
DOD USE ONLY	DEPT.	[] A [] N [] AF [] DLA [] NSA [] CNDN [] NASA	[] ESSENTIAL [] SUGGESTED	
Recommended Disposition of Comment: [] ACCEPTANCE [] NON-ACCEPTANCE (see reason) [] WITHDRAW [] MODIFY [] DISCUSS [REASON]				
Final Disposition of Comment: [] ACCEPTANCE [] NON-ACCEPTANCE [] WITHDRAW [] MODIFY				

FORM 155